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(54) Paper web and a method for the production thereof

(57) The invention concerns a method for producing a paper web. According to the method a stock is produced from the fibrous raw material and the stock is formed to a web which is dried on a paper machine. According to the invention the stock is formed from a mechanical pulp prepared from wood material of the *Populus* family and from bleached chemical spruce pulp, whereby the amount of the mechanical pulp is 20 to 70 weight-% and the amount of the bleached chemical softwood pulp is 80 to 30 weight-% of the dry matter of the stock. It is preferred to use an aspen pulp, over 70 % of the fiber fractions of which comprise fiber fractions +100, +200 and -200, and the proportion of the -200 fraction is 45 % or less. A coated fine paper can be produced from the paper web whose properties are better than those of a traditional fine paper having the corresponding bulk and grammage, on the same opacity level the paper produced by the invention will give a yield gain of up to more than 20 %.

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De cription

[0001] The present invention relates papermaking. In particular the invention concems a method according to the preamble of claim 1 for producing a paper web. According to a method of this kind, a fibrous raw material is slushed to form a stock, a web is formed from the stock and the web is dried.

[0002] With the aid of the present invention it is possible to produce a base paper which is particularly well suited to the manufacture of fine paper. The surface weight of a base paper of this kind is generally 20 to 200 g/m^2.

[0003] High-quality printing matters, such as brochures, advertising materials and catalogues, are made from fine papers which have good opacity, an even surface structure and high brightness.

[0004] Traditionally, fine papers have been manufactured from cellulosic hardwood or softwood pulps or mixtures thereof. The problem associated with the known art is that it is not possible at low grammage to reach sufficiently high opacity for the pulp or the paper manufactured therefrom. The formation of the chemical pulp and the paper made from it remains rather poor when high opacity is aimed at.

[0005] Light, coated paper qualities containing mechanical pulp are also known in the art. These are manufacture from a mechanical pulp made from spruce and they usually contain about 1/3 to 1/4 softwood pulp which reinforces the pulp and improves the strength properties of the paper.

[0006] The particular advantages of mechanical pulps in comparison to chemical pulps are their lower production costs and greater yield. The coarse, stiff fibers of the pulp lead, however, to fiber coarsing, which shows in offset printing. Further, the disadvantages of groundwood of spruce include its poor dewatering at low drainability and the large energy consumption of the whole pulping process. A problem of known papers based on groundwood is also their low brightness and poor brightness stability. They are not either shelf stable if spruce GW has been used.

[0007] Paper qualities containing mechanical pulps and combinations of mechanical pulps and chemical pulps, respectively, have not been used for fine papers. Instead, said types of papers (e.g. LWC) are primarily used as magazine papers.

[0008] It is an object of the present invention to eliminate the problems of the prior art and provide a solution for producing a base paper suitable for the manufacture of fine papers. It is also an object of the present invention to provide a fine paper of a novel kind, having high brightness and good smoothness and which further exhibits good opacity and excellent printability due to good formation.

[0009] The present invention is based on the concept of combining groundwood of hardwood and chemical pulp of softwood and of producing a base paper from a mixture of the mechanical and the chemical pulp. In connection with the present invention it has been found that a mechanical pulp (in particular Pressure Ground Wood, PGW) manufactured from aspen and other wood species of the *Populus* family contain a great amount of short fibers which improve the traditionally insufficient bulk and light scattering of fine paper. Although the strength properties of aspen GW, as regards, for example ScottBond strength, are not entirely sufficient, by combining aspen GW with a chemical pulp produced from softwood, it becomes possible to produce a basepaper which exhibits excellent opacity at high brightness and an even surface and good strength. Due to the good bonding strength of softwood, aspen GW can be used in an amount of up to 30 to 70 % of the dry weight of the pulp.

[0010] More specifically, the solution according to the present invention is mainly characterized by what is stated in the characterizing part of claim 1.

[0011] Considerable advantages are obtained by means of the invention. Thus, using the base paper according to the invention it is possible to obtain better opacity on the same level of brightness as that exhibited for traditional fine papers. The paper contains more fines and its bulk and opacity are greater, which gives it good printing properties. Surprisingly, we have found that by means of the present invention it has become possible at lower grammage to produce a fine paper having an extremely high brightness. When the fine papers produced from the present base paper are compared with traditional fine papers, thanks to the low grammage, a yield gain of up to about 20 % can be obtained; on the same opacity level the present paper will give more printing surface per weight unit than traditional fine papers.

[0012] The short-fibered aspen gives the paper good light scattering properties.

[0013] According to the invention it is therefore possible to provide a paper which fulfils all the quality requirements of coated fine papers consisting solely of chemical pulp but which, at the same time, provides high opacity and bulk and excellent printability properties.

[0014] In the following, the invention, its features and benefits will be examined in greater detail with reference to a detailed description and a number of working examples.

[0015] The fiber structure of aspen and wood species belonging to the same family differ from the fiber structures of the hardwood species most frequently used for pulp making, such as birch. The dimensions of the aspen fiber, the fiber length and width are smaller than for spruce and birch. The tracheids of aspen are smaller (length 0.9 mm) than the tracheids of birch (1.0 - 1.1 mm). In both, the proportion of vasculum cells is about 25 %. Traditionally, the tubular cells contained in aspen have been considered to cause runability problems on the paper machine and they have not been believed to provide for bonding. As a result of the short fibers and the poor bonding of the vasculum cells, dusting

of the paper can occur on the paper machine and during posttreatment.

[0016] According to the present invention it has now surprisingly been found that by using a combination of mechanical pulp produced from aspen and chemical softwood pulp; the runability problems caused by the tubular cells can be avoided and a pulp can be produced which has impeccable strength properties. Since the aspen pulp has shorter fibers than the birch pulp and even much shorter than spruce, at a given grammage there are more aspen fibers than birch or spruce fibers. This leads to a greater light scattering coefficient and bulk in the present invention. Further, the advantageous fiber length distribution gives the paper an excellent formation i.e. variation of the grammage of paper on a small scale, typically < 3 g/m^2. The smoothness of the paper is also good.

[0017] Due to all these factors, it is now possible to achieve a base paper which can be coated for production of high-quality fine papers, which have excellent printability properties.

[0018] The advantages of the special aspen pulp in comparison to spruce groundwood comprise high brightness and brightness stability. The stability of the brightness is in particular due to the low lignin-content of aspen groundwood or corresponding mechanical pulp and to the low concentration of carbonyl groups compared to spruce groundwood. Further, it should be pointed out that a paper web produced from aspen has clearly better dewatering properties than a web produced from spruce. The shorter dewatering time and the higher dry matter content together give a sheet with more porosity.

[0019] The greatest advantage of the fiber distribution of aspen is obtained when the pulp has been beaten to the drainability of fine papers. It should be mentioned that spruce has to be refined to a higher degree of beating because of the stiff fibers containined therein. The long and stiff fibers of mechanical pulps produced from spruce cause a roughening of the paper surface fibers during coating and, in particular, during printing. The phenomenon is rather typical for mechanical printing papers and it substantially deteriorates the quality of the printing surface. The requirements for the printing surface of fine papers are very strict and no fiber rising of the paper surface is acceptable. With the particular aspen pulp according to the present invention, not fiber roughening problems occur, which relates to the fact that practically all long and stiff fibers of the +14 and +28 fractions have been eliminated.

[0020] As an example of the fiber length distribution of aspen, the following table can be presented which indicates the fiber fractions retained by various sieves (mesh). The determination have been made from the stocks which are fed to the paper machine and the table compares aspen fibers to birch and spruce fibers, respectively:

Table 1

	Aspen PGW	Birch pulp	Spruce PGW
Fiber fractions			
+ 14	0 %	0.1 %	0.4 %
+ 28	1.6 %	7.8 %	10.6 %
+ 48	16.0 %	42.3 %	21.8 %
+200	43.0 %	36.5 %	33.5 %
-200	39.4 %	13.3 %	33.7 %
Freeness, CSF ml	50		30
Pulmac shives 0.8 mm/mg/g	<0.2	0	1

[0021] The average fiber length of aspen of PGW is smaller than of spruce (FS is typically about 0.54 ± 0.01).

[0022] Preferably the mechanical aspen pulp contains about 10 to 20 % of +20... +48 mesh fibers, which confer mechanical strength to the pulp. In order to maximize light scattering, the portion of +100, +200 and -200 fractions should be as large as possible.

[0023] Preferably they stand for distinctly more than 50 % of the whole pulp. In particular their proportion of the whole pulp is over 70 %, preferably over 80 %. On the other hand, the amount of the smallest fraction, i.e. the -200 mesh, should not be too large, because then dewatering on the paper machine would become more difficult. Preferably the proportion of this fraction is smaller than 50 %, in particular 45 % or less.

[0024] The total proportion of + 14 and +28 mesh fiber fractions is below 10 %, preferably below 5 %, and in particular below 3 %. The amounts of Pulmac shives at 0.8 mm/mg/g are below 1, in particular below 0.5.

[0025] In addition to the aspen mentioned above, pulp produced from any mechanical pulp made of a tree of the *Populus* family can be used for the base paper. Suitable species are, for example, *P. tremula, P. tremuloides, P balsamea, P. balsamifera, P. trichocarpa* and *P. heterophylla*. A preferred embodiment comprises using aspen (trembling aspen, *P. tremula*; Canadian aspen, *P. tremuloides*), or aspen varieties known as hybride aspens produced from different base aspens by hybridizing as well as other species produced by recombinant technology, or poplar. The raw

material is processed to groundwood (GW) or pressure groundwood (PGW) or it is disintegrated to chips and the chips are used for producing thermomechanical pulp (TMP) of chemimechanical pulp (CTMP) in a manner known *per se*.

[0026] The mechanical pulp is bleached after grinding or refining, respectively. Preferably the pulp is peroxide bleached at alkaline conditions. According to a preferred embodiment the pulp is bleach d with a one, two or multistage bleaching sequence, the pulp being acidified between the bleaching stages and the peroxide residue being reduced. Generally the peroxide dosage is about 2 to 3.5 weight-% of the dry matter of the pulp, for aspen pulp 0.5 to 1.5 %, in particular 0.7 to 1.2 %. A dithionite bleaching step comprising the treatment of the pulp with $Na_2S_2O_4$ can be incorporated into the peroxide bleaching sequence.

[0027] The mechanical pulp is washed before bleaching and after the bleaching with a mixture of water from the pulping section and a clarified recirculation water of the paper machine in a washing press (fabric press) by using typically about 0.1 to 10 m^3 water per ton of pulp. By using the washing press water is removed from the pulp in order to increase the dry matter content of the pulp to about 20 to 30 %. The waters from the dewatering are recycled to the production of the mechanical pulp. By the washing press it is possible to prevent impurities from being transferred to the paper machine.

[0028] The bleached pulp is then refined to the desired degree of beating, which is, e.g. 30 to 100 CSF, preferably about 40 to 80 CSF.

[0029] A stock is formed from the mechanical pulp together with a chemical pulp. The stock can contain other fiber materials and additives, such as fillers. Calcium carbonate is an example of a filler. The dry matter content of the stock is about 0.1 to 5 %. Clarified filtrate of a circulating water of the paper machine is used as the aqueous phase of the stock. The chemical pulp used comprises in particular a fully bleached chemical softwood pulp, whereby a paper w b suitable as a base paper of fine papers is obtained. Said web has high bulk, high brightness and high opacity and good formation. The amount of the mechanical pulp is then for example 20 to 70 weight-%, preferably 30 to 60 weight-%, and the amount of the bleached softwood pulp is for example 80 to 30 weight-%, preferably 70 to 40 weight-% of the dry matter of the stock.

[0030] Preferably the chemical pulp used for the preparation of the base paper is produced by method known as a modified batch-type cooking (Superbatch Cook). This cook is discribed in literature [cf., for example, Malinen, R. Pap ri ja Puu (Paper and Timber), 75 (1993) 14-18]. The cook in question is a modified cooking method which utilizes an alkaline cooking liquor just as the sulphate cook, but wherein delignification has been enhanced so that the kappa number of the chemical pulp is lowered without a significant reduction of viscosity. Typically with a Superbatch process, pulp is cooked to a kappa number of 20 or less.

[0031] A paper web is formed from the stock of aspen pulp and chemical pulp on a paper machine. Preferably a gap former is used for web forming. In said technique the web is dried between two webs, water being removed in both directions. Thus, as regards printability, an advantageous distribution of the fines is obtained in the direction of the Z axis; the fines are gathered on both surfaces of the base paper web. A "smiling" distribution is formed in transversal direction when the fines accompany the leaving water. A paper according to the invention contains substantially much more fibes than for example a traditional spruce groundwood -based LWC. The fines of the aspen and the fillers added to the stock are accumulated on the surfaces of the paper. Because aspen has a rather good brightness and a good brightness stability, it is possible to get abundant amounts of aspen fibers on the surface of the paper. The coating is also accumulated on the surface of such a paper and, thus, a good coverage can be obtained. Therefore, by combining the use of a gap former with the present fiber mixture it is possible to provide a base paper which has rather advantageous printing properties after coating.

[0032] As regards the runability of the above-described fiber mixture it is particularly advantageous to set the dosing pH of the stock at 6.8 to 7.2 and the pH of the machine pulp at 7.1 to 7.5, preferably at about 7.1 to 7.3. If necessary a suitable base or acid is used for setting the pH and for adjusting the pH during paper making. The bases used comprise in particular alkali metal bicarbonates or carbonates and alkali metal hydroxides. The acids used include mineral acids and acid salts. The preferred acids are sulphuric acid and its acid salts such as alum, and the preferred base is sodium bicarbonate. The consistency of the headbox is adjusted to 0.6 to 0.8.

[0033] By using the invention, the following properties can be obtained for the base paper:

Fiber composition:	30 to 60 weight-% mechanical aspen pulp (aspen groundwood) 70 to 40 weight-% chemical softwood pulp (bleached chemical pine pulp)
Grammage:	30 to 200 g/m^2
Bulk:	1.2 to 1.6 cm^3/g
Opacity:	over 78 % (at a grammage of 50 to 110 g/m^2 over 87 %)
Brightness:	over 78 % (at a grammage of 50 to 110 g/m^2 over 82 %)

[0034] From a base paper of this kind a high-quality fine paper can be produced by coating it twice with a suitable coating colour containing pigments. The coating colour can be applied on the material web in a manner known *per se*.

The method according to the invention for coating paper and/or paperboard can be carried out on-line or off-line by using a conventional coater, i.e. a doctor blade coater, or by film press coating or by surface spraying.

[0035] According to a particularly preferred embodiment, the paper web is double-coated, whereby the first coating is for example carried out by the film press method, and the second coating is performed by doctor blade coating. The precoating is preferably performed by film press coating e.g. at high speed (at least 1450 m/s, preferably even 1600 m/min or more). Generally, the amount of coating colour applied to the web by the film press method is typically about 5 to 50 g coating colour/m^2, whereas the corresponding amount for doctor blade coating is 10 to 60 g coating colour/m^2. The coating weights have been calculated from the dry matter of the coating colour.

[0036] The solution according to the invention is particularly well suited to coating by using in the coating colour a pigment with a steep distribution, whereby the pigment will provide good coverage and the paper will have good opacity. By steep pigment size distribution is meant a distribution in which a maximum of 35 % of the particles are smaller than 0.5 μm and preferably a maximum of 15 % are smaller than 0.2 μm.

[0037] After coating and supercalendering the fine paper obtained typically has the following properties:

Grammage:	50 to 220 g/m^2
Bulk:	0.7 to 0.9 cm^3/g
Opacity: :	over 90 % (at a grammage of 50 to 110 g/m^2 over 94 %)
Brightness:	over 90 % (at a grammage of 50 to 110 g/m^2 over 92 %)
Smoothness:	less than 1 μm
Gloss:	over 70 %

[0038] The following examples illustrate the invention. The paper properties indicated in the examples have been measured using the following standard methods:

Brightness: SCAN-P3:93 (D65/10°)
Opacity: SCAN-P8:93 (C/2)
Smoothness: SCAN-P76:95
Bendtsen coarseness: SCAN-P21:67
Gloss: Tappi T480 (75°) and T653 (20°)

Example 1

Manufacture of aspen groundwood on a pilot apparatus

[0039] Pressure groundwood was prepared with a pressurized PGW70 process. The pulps were ground with a grinding stone having an average grain size of 73 mesh. The grindings were carried out with a one oven pilot grinder. The grinder was operated using the following settings: .

- Inner pressure of grinder: 250 kPa,
- Flow of water jet: about 3.5 l/s (aimed consistency about 1.5 %)
- Temperatuer of water jet: 70 °C

[0040] The ground pulp was processed to a finished, bleached and postrefined pulp. The processing was performed sequentially as follows:

- Mainline screening;
- High-consistency refining of reject in two stages;
- Screening of refined reject;
- Combination of mainline and reject line accepts;
- Two-stage bleaching with peroxide + dithionite;
- Postrefinings

[0041] The screening of the pulp was made using fractionating slit screening technique. The refining of the reject was carried out at high consistency in two stages. In both refining stage the reject was precipitated before grinding with a twin fabric press and dilut d after the grinding with the effluent of the press. The reject refiner was provided with knives for high-consistency refining of pulp. Samples were taken after both refining steps. After the first step the sample was subjected to disintegration on a sample web and after the second step the disintegration was made in a container. The paper technical properties were only determined from the sample taken after the second refining step. The screen-

ing of the refined reject was made in a manner known *per se*.

[0042] The pulps were bleached with a two-stage peroxide and hydrosulphide bleaching in two batches.

[0043] First the pulp which were to be bleached were precipitated on a belt filter, and then they were fed to a high-consistency refiner operated with a rather large knife slit which was used as a chemical mixer. The peroxide solution which contained all bleaching chemicals was fed as screw water of the feed screw of the refiner. From the refiner the pulp was filled into large sacs in which the pulp was kept for about two hours.

[0044] The aimed bleaching chemical dosage (90 % of production) was:

H_2O_2	1.5 %, usually 0.8 - 1 %
NaOH	1.0 %
Na_2SiO_3	3.5 %
DTPA	0.5 %

[0045] DTPA was dosed mixed with the bleaching liquid.

[0046] The acidification of the pulp was carried out with a 93 % sulphuric acid which was diluted with water at the ratio 1:10. The diluted acid was dosed to the bleaching pulp 8 l per sac.

[0047] From the slushed and acidified pulp, CSF, shives, BmcN-fractions and brightness were determined. During double-bleaching the peroxide residue was reduced after acidification by adding to the pulp in a pulper 1.33 kg sodium sulphite per sac. Then the pH was set at 6.5 by adding 50 % sodium hydroxide. In the previous test runs the aimed pH value was 6.0.

[0048] After this, a 10 % $Na_2S_2O_4$ solution was added for performing the dithionite bleaching. The dosing was 0.6 %. From the second bleaching batch pulp and paper technical properties were determined after double bleaching.

[0049] The postrefining was carried out at low consistency with a Tampella T224 disc refiner. The pulp was refined at about 70 kWh/t specific energy consumption. The drainage of the finished pulp was 50 ml CSF.

[0050] The fiber size distribution of the pulp was the following:

Fiber fraction	Percentage
+14	0%
+28	1.6 %
+48	16.0 %
+200	43.0 %
-200	39.4 %

Example 2

Preparation of base paper for fine papers

[0051] A base paper was produced from a mechanical aspen pulp (GW) and chemical pine pulp, which were mixed at a weight ratio of 40 to 60. Ground calcium carbonate was added as a filler to the suspension in an amount of about 10 % of the fibrous material.

[0052] The base paper was produced on a gap former. The properties of the base paper were the following:

grammage	53.3 g/m^2
bulk	1.45 cm^3/g
opacity	88 %
brightness	82.5 %
coarseness	240 ml/min
porosity	170 ml/min
filler content	12 %

[0053] Comparative test carried out in connection with the invention have shown that the grammage of the base paper is at least 10 % smaller than that of a base paper produced entirely from a bleached chemical pulp and having the corresponding opacity and brightness.

Exampl 3

Production of fine papers

[0054] A base paper produced according to Example 2 was coated twice, first with the film press method and then with doctor blade coating.

[0055] A calcium carbonate pigment having the particle size distribution shown in Table 2 was used in the coating colours:

Table 2.

Particle size distribution of the carbonate pigment	
Max. particle size [µm]	Cumulative proportion of weight
5	99
2	95
1	70
0.5	35
0.2	10

[0056] The coating colour was produced in a manner known *per se* by mixing together the pigment, the binder and the other additives. The dry matter content of the precoating colour was 60 % and of the surface coating colour 61 %. The above described colours were used for coating the afore-mentioned base paper in the following conditions:

[0057] Precoating by the film press method: 9 g/m^2 per side; and the surface coating at a doctor blade station: 10.5 g/m^2 per side at a speed of 1500 m/min. The coated paper was super-calendered.

[0058] The properties of the end products were determined and compared to those of two commercially available finer papers, viz. Lumiart (Enso) and Nopacoat (Nordland Papier). The results will appear from Table 3:

Table 3.

Optical properties of a double-coated fine paper			
	Paper according to the invention	Lumiart	Nopacoat
Grammage [g/m^2]	80	100	99
Bulk	0.85	0.83	0.78
Opacity [%]	94	92.7	92.6
Brightness [%]	94	91	96.7
Smoothness pps 10 [µm]	0.8	1.2	0.8
Gloss [%]	73	66	71

[0059] Table 3 shows that the properties of a fine paper produced by the invention are better in all respects than those of comparative papers having corresponding bulk and grammage. On an equal level of opacity the yield gain is even more than 20 %.

Claims

1. Method for producing a paper web, according to which method

   - a stock is formed from a fibrous raw material,
   - the stock is formed into a web and
   - the web is dried,

   characteriz d in that

- the stock is formed from a mechanical pulp of a wood raw material of the *Populus* family and a bleached chemical softwood pulp, the amount of mechanical pulp being 20 to 70 wt-% and the amount of bleached softwood pulp being 80 to 30 weight-% of the dry matter of the stock.

2. The method according to claim 1, wherein 30 to 60 weight-% of the dry matter of the pulp is formed by mechanical pulp and 70 to 40 weight-% is formed by chemical softwood pulp.

3. The method according to claim 1 or 2, wherein the mechanical pulp is manufactured from *P. tremula, P. tremuloides, P balsamea, P. balsamifera, P. trichocarpa* or *P. heterophylla*.

4. The method according to any of claims 1 to 3, wherein the mechanical pulps is produced from aspen (*P. tremula*), Canadian aspen (*P. tremuloides*) or aspen varieties known as hybride aspens produced from different base aspens by hybridizing as well as other species produced by recombinant technology.

5. The method according to any of claims 1 to 4,. wherein about 10 to 20 % of the fiber sizes of the mechanical pulp are between +28 and +48 mesh.

6. The method according to claim 5, wherein the fiber fractions +100, +200 and -200 stand for more than 70 %, preferably more than 80 %, of the fiber fractions of the pulp and the proportion of the -200 fraction is 45 % or less.

7. The method according to any of the preceding claims, wherein the mechanical pulp is pressure groundwood.

8. The method according to any of the preceding claims, wherein the web is formed with a gap former.

9. The method according to any of the preceding claims, wherein bleached mechanical and fully bleached chemical pulps are used.

10. A base paper prepared according to a method according to any of the preceding claims, **characterized** that 30 to 60 weight-% of its fibers are derived from a mechanical aspen pulp, 70 to 40 weight-% from chemical softwood pulp, its grammage is 30 to 200 g/m^2, bulk 1.2 to 1.6 cm^3/g and opacity and brightness over 78 %.

11. The base paper according to claim 10, wherein the fines of the paper is enriched on the surface of the paper.

12. The base paper according to claim 11, wherein the surfaces of the paper contain enriched fines and filler added to the stock.

13. The base paper according to any of claims 10 to 12, wherein its formation is smaller than 3.

14. The base paper according to claim 13, wherein its grammage is at least 10 % smaller than that of a base paper essentially entirely prepared from bleached chemical pulp having corresponding opacity and brightness.

15. Fine paper, **characterized** in that it is produced from a base paper according to any of claims 1 to 14 which has been double-coated, whereby at least one of the coating layers being formed from a coating colour containing a pigment with a steep particle size distribution.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 66 0093

Category	DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y A	DATABASE PAPERCHEM THE INSTITUTE OF PAPER SCIENCE AND TECHNOLOGY, ATLANTA, GA, US PISAREVSKAYA, E. A. ET AL: "PRODUCTION OF BLEACHED ASPEN GROUNDWOOD AT THE ZHIDACHEV MILL" XP002086900 * abstract * & BUMAZH. PROM. NO. 1: 17-18 (JAN. 1981). 'RUSS.!, ---	1-4,9 1,10 7,10,14	D21H11/10 D21H19/82
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	7 December 1998	Nestby, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	7 December 1998	Nestby, K

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